



***DARPA*Tech**

2002 Symposium

Transforming
Fantasy



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Innovative Space-Based Radar Antenna Technology (ISAT) Program

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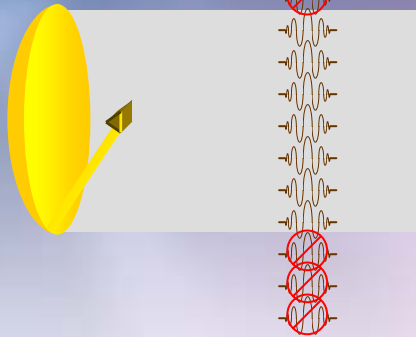
Aperture Is Critical to Photon Collection Applications

Signal Gain

Photon
Collection Area

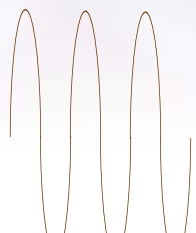
Antenna
Beam Pattern

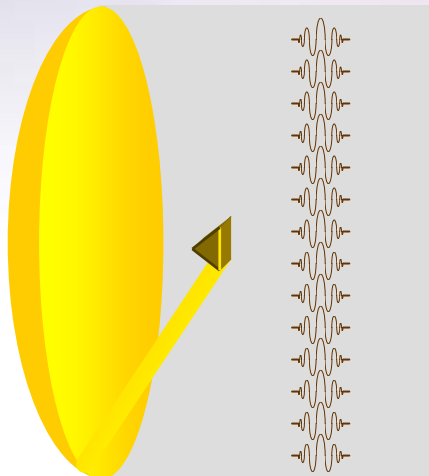

Lower



**Wider
Beamwidth**

**Lower
Resolution**


Higher



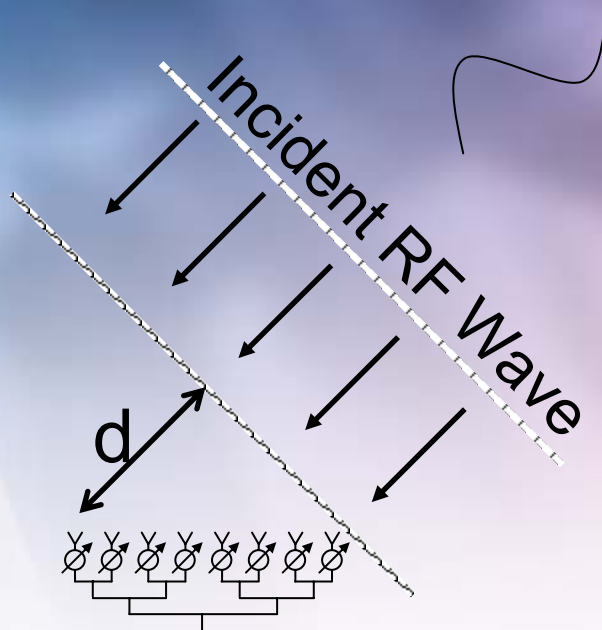
**Narrower
Beamwidth**

**Higher
Resolution**



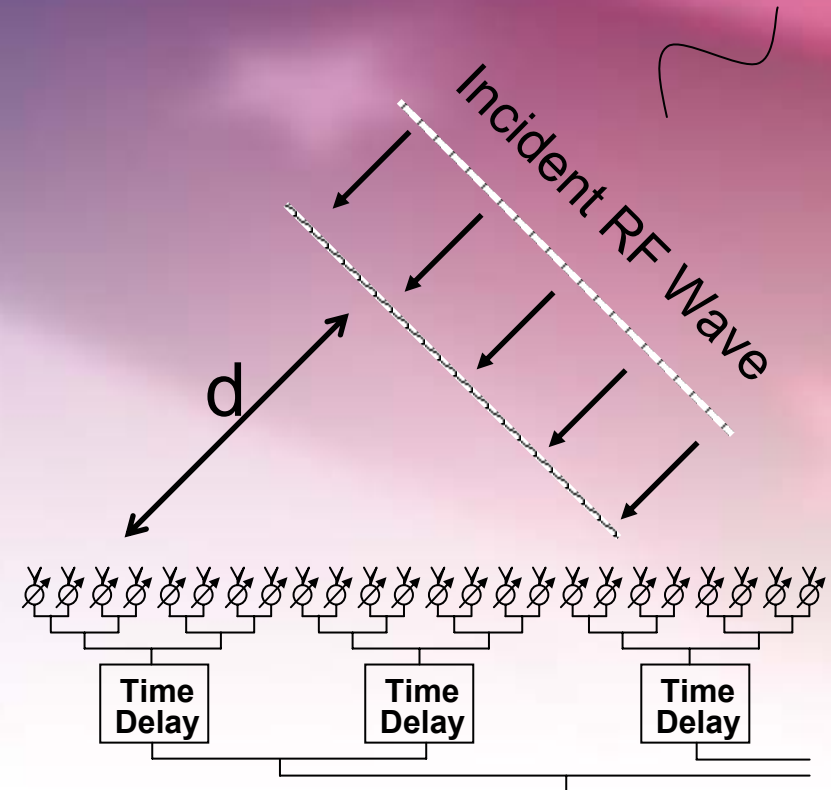
Antenna Architecture Challenges

Phase Shifters \Rightarrow Narrowband



$$\text{Extra Phase} = 360^\circ \times d/\lambda$$

True Time Delays \Rightarrow Wideband

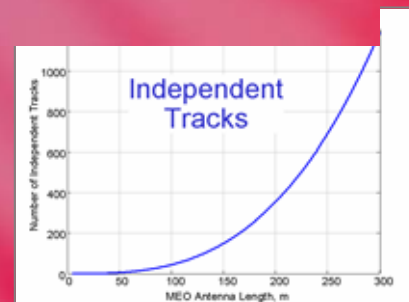
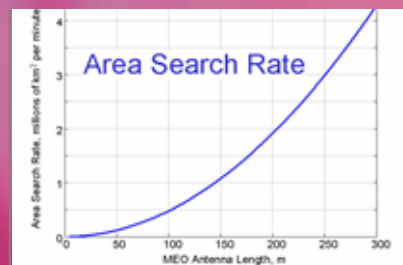
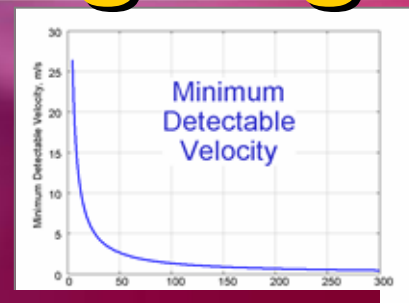
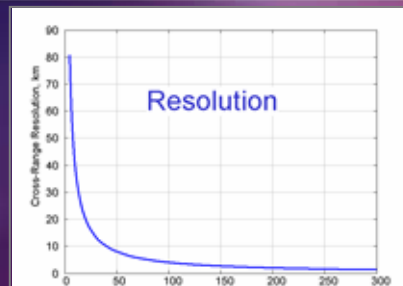
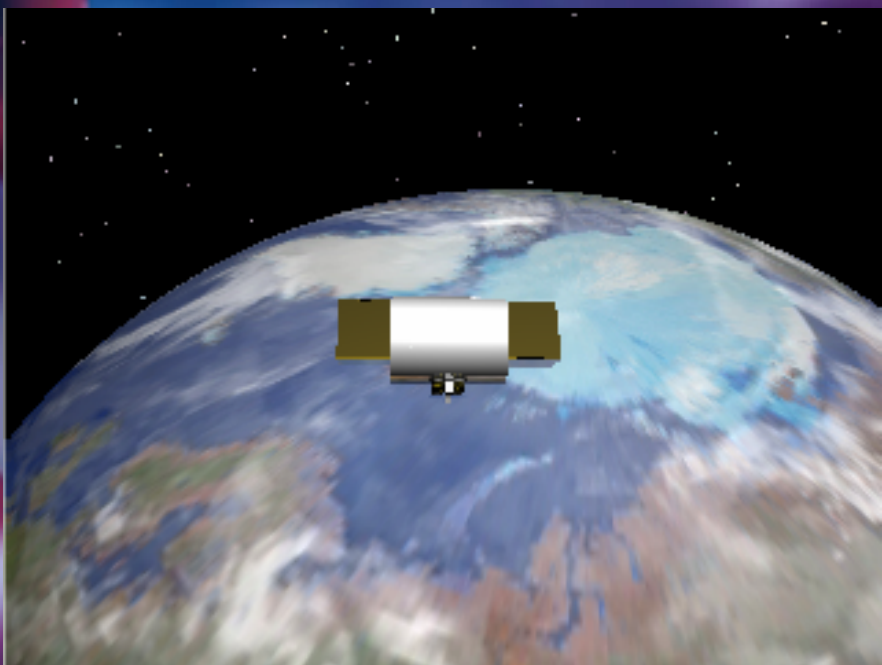


$$\text{Extra Time} = d/c$$

Time Delay Options

- Digital
- Photonics

Benefits of Going Big

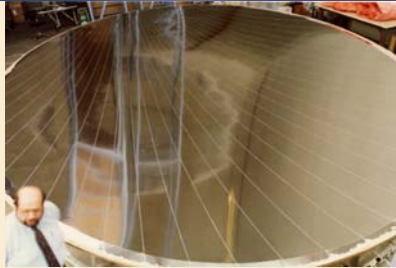


Enabling Technologies



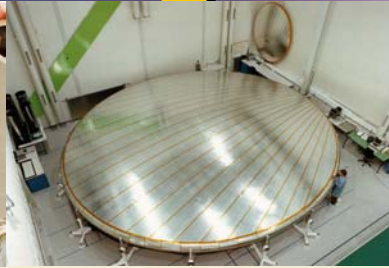
ECHO BALLOONS

1960



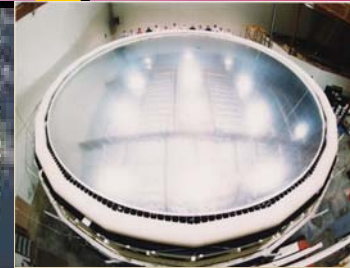
REFLECTOR ANTENNAS

1980

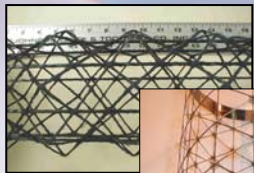


INFLATABLE ANTENNA EXPERIMENT

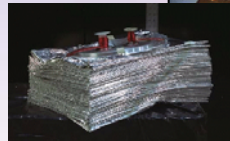
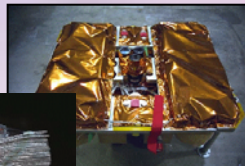
1996



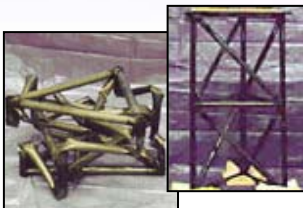
ILC DOVER



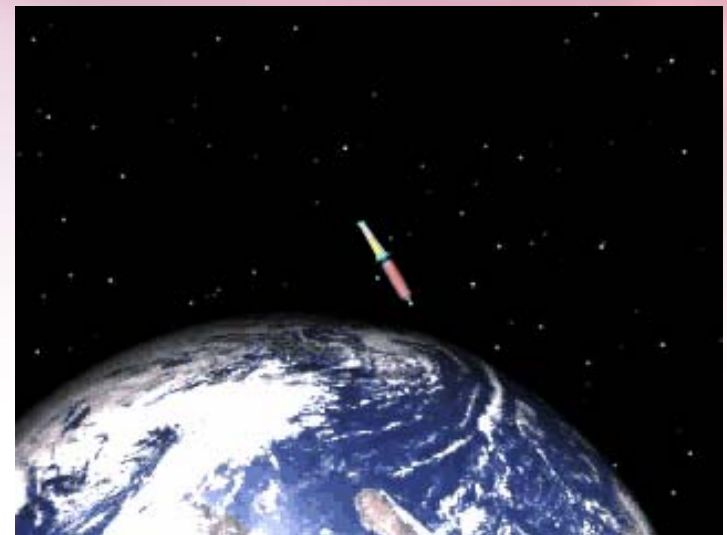
L'Garde



Rigidized inflatables and composite joint materials support large aperture deployments



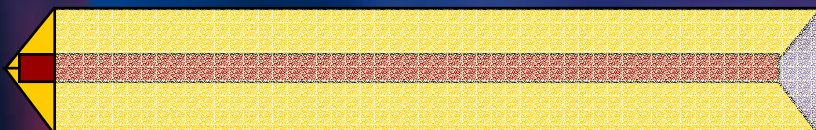
Foster-Miller



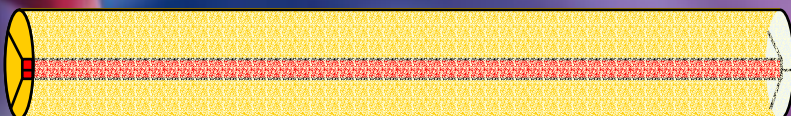
L'Garde deployment concept

Antenna Design and Calibration

Space-Fed Lens



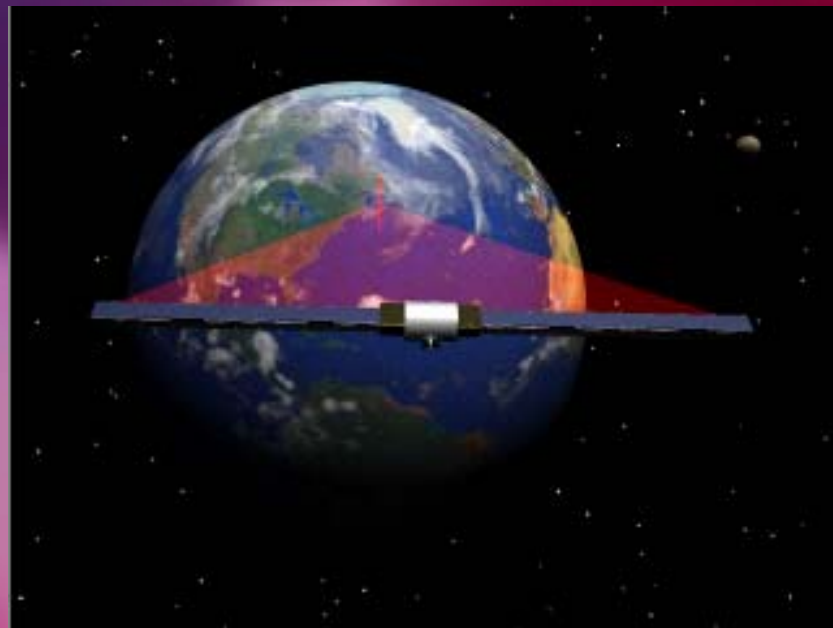
Reflector



Active ESA



Cooperative beacons calibrate aperture within an orbit



ISAT Technology Needs

- ▶ Advanced antenna architectures
- ▶ Lightweight radhard materials and electronics
- ▶ Reliable deployment technologies
- ▶ Compressible materials and components
- ▶ Reduced cost-per-kg launch technologies
- ▶ Advanced calibration concepts



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